WHAT IS CLAIMED IS:

1. An osteoimplant which comprises a solid aggregate of bone-derived elements, adjacent bone-derived elements being bonded to each other through chemical linkages between their surface-exposed collagen.

2. The osteoimplant of Claim 1 wherein the bone-derived elements are superficially demineralized particles, strips or sheets of allogenic, xenogenic cortical and/or cancellous bone.

3. The osteoimplant of Claim 1 wherein the bone-derived elements are substantially completely demineralized particles, strips or sheets of allogenic, xenogenic cortical and/or cancellous bone.

4. The osteoimplant of Claim 1 containing at least one other component.

5. The osteoimplant of Claim 4 wherein the component is selected from the group consisting of reinforcing particle or fiber, filler, bone-growth inducing substance, growth factors, fully mineralized allogenic or xenogenic bone, cellular material, genetic material, calcification-controlling agent, hydration agent, inorganic compounds and polymers.

6. The osteoimplant of Claim 1 possessing a cross section for at least a portion of its length which is, or approximates, a circle, oval or polygon, the implant optionally possessing a cavity for at least a portion of its length.

7. The osteoimplant of Claim 1 wherein the chemical linkages are formed by chemical crosslinking, application of energy, dehydrothermal treatment or

enzymatic treatment.

8. The osteoimplant of Claim 1 possessing a compression strength of from about 10 to about 200 MPa.

9. The osteoimplant of Claim 1 possessing a hydration-facilitating agent.

10. The osteoimplant of Claim 1 wherein the hydration-facilitating agent is glycerol.

11. An osteoimplant which comprises a solid aggregate of bone-derived elements, adjacent bone-derived elements being bonded to each other through chemical linkages between their surface-exposed collagen, wherein the chemical linkages are formed by exposing the bone-derived elements to a chemical crosslinking agent.

12. The osteoimplant of Claim 11 wherein the chemical crosslinking agent is selected from the group consisting of monoaldehydes, dialdehydes, polyepoxy compounds, polyvalent metallic oxides, organic tannins, phenolic oxides derived from plants, hydrazide, dicyclohexyl carbodiimide, hexamethylene diisocyanate, sugars and enzymes.

13. The osteoimplant of Claim 11 wherein the bone-derived elements are exposed to the chemical crosslinking agent by placing the bone-derived elements in a solution of chemical crosslinking agent.

14. The osteoimplant of Claim 11 wherein the bone-derived elements are exposed to the chemical crosslinking agent by exposing the bone-derived elements to vapors of the chemical crosslinking agent.

15. The osteoimplant of Claim 11 wherein the chemical crosslinking agent is a polyepoxy compound.

16. The osteoimplant of Claim 11 wherein the chemical crosslinking agent is a monoaldehyde or dialdehyde.

17. The osteoimplant of Claim 11 wherein the chemical crosslinking agent is formalin.

18. The osteoimplant of Claim 11 wherein the chemical crosslinking agent is polyethylene glycol diglycidyl ether.

19. The osteoimplant of Claim 11 wherein the bone-derived elements are superficially demineralized.

20. The osteoimplant of Claim 11 further comprising at least one other component.

21. The osteoimplant of Claim 20 wherein the component is selected from the group consisting of reinforcing particles, reinforcing fibers, fillers, bone-growth inducing substances, growth factors, fully mineralized bone, adhesives, plasticizers, flexibilizing agents, cellular material, genetic material, calcification-controlling agents, hydration facilitating agents, biostatic agents, biocidal agents, polymers, inorganic compounds, substances imparting radiopacity and metallic meshes.

22. The osteoimplant of Claim 11 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 10 to about 200 MPa.

23. The osteoimplant of Claim 11 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 20 to about 200 MPa.

24. The osteoimplant of Claim 11 wherein the bone-derived elements are sheets obtained by longitudinally slicing the diaphyseal region of whole cortical bone.

25. The osteoimplant of Claim 24 wherein each sheet is approximately 1.5 mm thick.

26. The osteoimplant of Claim 24 wherein the sheets are assembled into a layered structure prior to exposing the sheets to a chemical crosslinking agent.

27. The osteoimplant of Claim 24 wherein at least one of the sheets possesses a fully or partially demineralized outer surface and a nondemineralized or partially demineralized core.

28. The osteoimplant of Claim 24 wherein at least one of the sheets is fully demineralized.

29. The osteoimplant of Claim 24 wherein at least one of the sheets is coated with demineralized bone powder.

30. The osteoimplant of Claim 26 possessing a total thickness of from about 2 to about 20 mm.

31. The osteoimplant of Claim 24 configured and dimensioned as a square or rectangle.

32. The osteoimplant of Claim 24 configured and dimensioned as a cylinder.

33. The osteoimplant of Claim 24 configured and dimensioned as an intervertebral insert, a long bone, a cranial bone, a bone of the pelvis, or a bone of the hand or foot or section thereof.

34. The osteoimplant of Claim 11 wherein the solid aggregate of bone-derived elements possesses a network of pores, perforations, apertures, channels, or spaces.

35. The osteoimplant of Claim 34 wherein the pores, perforations, apertures, channels or spaces have incorporated therein one or more bone growth inducing or bone healing substances.

36. An osteoimplant which comprises a solid aggregate of bone-derived elements, adjacent bone-derived elements being bonded to each other through chemical linkages between their surface-exposed collagen, wherein the chemical linkages are formed by application of energy.

37. The osteoimplant of Claim 36 wherein the energy is heat.

38. The osteoimplant of Claim 36 wherein the energy is radiant energy.

39. The osteoimplant of Claim 36 wherein the energy is ultraviolet light or microwave energy.

40. The osteoimplant of Claim 36 wherein the application of energy comprises dye-mediated photo-oxidation.

41. The osteoimplant of Claim 36 wherein the bone-derived elements are superficially demineralized.

42. The osteoimplant of Claim 36 further comprising at least one other component.

43. The osteoimplant of Claim 42 wherein the component is selected from the group consisting of reinforcing particles, reinforcing fibers, fillers, bone-growth

inducing substances, growth factors, fully mineralized bone, adhesives, plasticizers, flexibilizing agents, cellular material, genetic material, calcification-controlling agents, hydration facilitating agents, biostatic agents, biocidal agents, polymers, inorganic compounds, substances imparting radiopacity and metallic meshes.

44. The osteoimplant of Claim 36 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 10 to about 200 MPa.

45. The osteoimplant of Claim 36 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 20 to about 200 MPa.

46. The osteoimplant of Claim 36 wherein the bone-derived elements are sheets obtained by longitudinally slicing the diaphyseal region of whole cortical bone.

47. The osteoimplant of Claim 46 wherein each sheet is approximately 1.5 mm thick.

48. The osteoimplant of Claim 46 wherein the sheets are assembled into a layered structure prior to applying energy to the sheets.

49. The osteoimplant of Claim 46 wherein at least one of the sheets possesses a fully or partially demineralized outer surface and a nondemineralized or partially demineralized core.

50. The osteoimplant of Claim 46 wherein at least one of the sheets is fully demineralized.

51. The osteoimplant of Claim 46 wherein at least one of the sheets is coated with demineralized bone powder.

52. The osteoimplant of Claim 48 possessing a total thickness of from

about 2 to about 20 mm.

53. The osteoimplant of Claim 46 configured and dimensioned as a square or rectangle.

54. The osteoimplant of Claim 46 configured and dimensioned as a cylinder.

55. The osteoimplant of Claim 46 configured and dimensioned as an intervertebral insert, a long bone, a cranial bone, a bone of the pelvis, or a bone of the hand or foot or section thereof.

56. The osteoimplant of Claim 36 wherein the solid aggregate of bone-derived elements possesses a network of pores, perforations, apertures, channels, or spaces.

57. The osteoimplant of Claim 56 wherein the pores, perforations, apertures, channels or spaces have incorporated therein one or more bone growth inducing or bone healing substances.

58. An osteoimplant which comprises a solid aggregate of bone-derived elements, adjacent bone-derived elements being bonded to each other through chemical linkages between their surface-exposed collagen, wherein the chemical linkages are formed by dehydrothermal treatment.

59. The osteoimplant of Claim 58 wherein the bone-derived elements are superficially demineralized.

60. The osteoimplant of Claim 58 further comprising at least one other component.

61. The osteoimplant of Claim 60 wherein the component is selected from the group consisting of reinforcing particles, reinforcing fibers, fillers, bone-growth inducing substances, growth factors, fully mineralized bone, adhesives, plasticizers, flexibilizing agents, cellular material, genetic material, calcification-controlling agents, hydration facilitating agents, biostatic agents, biocidal agents, polymers, inorganic compounds, substances imparting radiopacity and metallic meshes.

62. The osteoimplant of Claim 58 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 10 to about 200 MPa.

63. The osteoimplant of Claim 58 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 20 to about 200 MPa.

64. The osteoimplant of Claim 58 wherein the bone-derived elements are sheets obtained by longitudinally slicing the diaphyseal region of whole cortical bone.

65. The osteoimplant of Claim 64 wherein each sheet is approximately 1.5 mm thick.

66. The osteoimplant of Claim 64 wherein the sheets are assembled into a layered structure prior to subjecting the sheets to dehydrothermal treatment.

67. The osteoimplant of Claim 64 wherein at least one of the sheets possesses a fully or partially demineralized outer surface and a nondemineralized or partially demineralized core.

68. The osteoimplant of Claim 64 wherein at least one of the sheets is fully demineralized.

69. The osteoimplant of Claim 64 wherein at least one of the sheets is

coated with demineralized bone powder.

70. The osteoimplant of Claim 66 possessing a total thickness of from about 2 to about 20 mm.

71. The osteoimplant of Claim 64 configured and dimensioned as a square or rectangle.

72. The osteoimplant of Claim 64 configured and dimensioned as a cylinder.

73. The osteoimplant of Claim 64 configured and dimensioned as an intervertebral insert, a long bone, a cranial bone, a bone of the pelvis, or a bone of the hand or foot or section thereof.

74. The osteoimplant of Claim 58 wherein the solid aggregate of bone-derived elements possesses a network of pores, perforations, apertures, channels, or spaces.

75. The osteoimplant of Claim 74 wherein the pores, perforations, apertures, channels or spaces have incorporated therein one or more bone growth inducing or bone healing substances.

76. An osteoimplant which comprises a solid aggregate of bone-derived elements, adjacent bone-derived elements being bonded to each other through chemical linkages between their surface-exposed collagen, wherein the chemical linkages are formed by enzymatic treatment.

77. The osteoimplant of Claim 76 wherein the enzymatic treatment comprises tissue transglutaminase.

78. The osteoimplant of Claim 76 wherein the bone-derived elements are superficially demineralized.

79. The osteoimplant of Claim 76 further comprising at least one other component.

80. The osteoimplant of Claim 79 wherein the component is selected from the group consisting of reinforcing particles, reinforcing fibers, fillers, bone-growth inducing substances, growth factors, fully mineralized bone, adhesives, plasticizers, flexibilizing agents, cellular material, genetic material, calcification-controlling agents, hydration facilitating agents, biostatic agents, biocidal agents, polymers, inorganic compounds, substances imparting radiopacity and metallic meshes.

81. The osteoimplant of Claim 76 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 10 to about 200 MPa.

82. The osteoimplant of Claim 76 wherein the solid aggregate of bone-derived elements possesses a compression strength of from about 20 to about 200 MPa.

83. The osteoimplant of Claim 76 wherein the bone-derived elements are sheets obtained by longitudinally slicing the diaphyseal region of whole cortical bone.

84. The osteoimplant of Claim 83 wherein each sheet is approximately 1.5 mm thick.

85. The osteoimplant of Claim 83 wherein the sheets are assembled into a layered structure prior to subjecting the sheets to enzymatic treatment.

86. The osteoimplant of Claim 83 wherein at least one of the sheets possesses a fully or partially demineralized outer surface and a nondemineralized or

partially demineralized core.

87. The osteoimplant of Claim 83 wherein at least one of the sheets is fully demineralized.

88. The osteoimplant of Claim 83 wherein at least one of the sheets is coated with demineralized bone powder.

89. The osteoimplant of Claim 85 possessing a total thickness of from about 2 to about 20 mm.

90. The osteoimplant of Claim 83 configured and dimensioned as a square or rectangle.

91. The osteoimplant of Claim 83 configured and dimensioned as a cylinder.

92. The osteoimplant of Claim 83 configured and dimensioned as an intervertebral insert, a long bone, a cranial bone, a bone of the pelvis, or a bone of the hand or foot or section thereof.

93. The osteoimplant of Claim 76 wherein the solid aggregate of bone-derived elements possesses a network of pores, perforations, apertures, channels, or spaces.

94. The osteoimplant of Claim 93 wherein the pores, perforations, apertures, channels or spaces have incorporated therein one or more bone growth inducing or bone healing substances.

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